

Application No.: 10/534,968Docket No.: 4590-399RECEIVED
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Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended): A method of determining the relative position of a mobile in relation to the known position of a reference station, each using an antenna for receiving radio signals originating from an arrangement of positioning satellites transmitting on at least two frequencies L1 and L2, this method comprising the steps of:

- periodically determining the periodic determination, for each of said frequencies, of a set of $2p$ pseudo-ranges, for ~~[[i.e.]]~~ p pseudo-ranges between the mobile and the p satellites and p pseudo-ranges between the reference station and the p satellites,

- supplying ~~[[the]]~~ supply of the pseudo-ranges to a position-calculating unit, and

- calculating ~~[[the]]~~ calculation ~~by this the~~ position-calculating unit of a relative position of the mobile in relation to the reference station ~~on the one hand~~ on the pseudo-ranges and ~~on the other hand~~ on an estimated position P_e of the mobile in relation to the reference station, wherein, this method being mainly characterized in that for a given set of $4p$ pseudo-ranges received by the position-calculating unit, ~~[[the]]~~ calculation calculating of the relative position, comprising the following steps:

- a) choosing a linear combination equation $aL_1 + bL_2$ of said frequencies L1 and L2 from a predetermined list having at least two linear combinations equation of frequencies,
- b) calculating ~~[[the]]~~ linear combinations of pseudo-ranges corresponding to the linear combination equation, and, on the basis of these linear combinations of pseudo-ranges and the estimated position P_e , calculating a precise relative position P_p of the mobile in relation to the reference station,
- c) choosing from the list the following linear combination equation, if it exists, and, in this case, reiterating step b), setting the estimated position P_e as equal to said precise position P_p , considering the estimated position to be said precise position P_p and using the same set of $4p$ pseudo-ranges to obtain an even more precise relative position,

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- d) reiterating step c) for all the linear combination ~~combinations~~ equations in the list.

2. (currently amended): The method according to claim 1, wherein the linear ~~combinations~~ combination equations in the list are determined in such a way that, from one calculation to the next, the corresponding wavelengths reduce progressively and the sensitivity to ionospheric errors also reduces progressively.

3. (currently amended): The method according to claim 1, wherein the first combination equation in the list is the combination equation $L1-L2$ ($a=1$, $b=-1$) and/or the last linear combination equation in the list is the combination equation $9L1-7L2$ ($a=9$, $b=-7$), $L1$ and $L2$ being the transmission frequencies of the satellites of the GPS system.

4. (currently amended): The method according to claim 1, wherein the intermediate combination equations ~~combinations~~ are preferably as follows: $2L1-L2$ ($a=2$, $b=-1$); $3L1-2L2$ ($a=3$, $b=-2$); $4L2-3L1$ ($a=4$, $b=-3$).

5. (currently amended): The method according to preceding claim 1, wherein step b) comprises the following two steps:

b1) calculating an approximate relative position P_a of the mobile in relation to the reference station on the basis of the chosen linear combination equation, P_e and a subset of $4p'$ pseudo-ranges corresponding to p' satellites, where p' is less than p and where the p' satellites chosen from the arrangement of p satellites are those which, taking into account the current geometry of the arrangement, are least sensitive to an error in the estimated position.

b2) calculating a precise relative position P_p of the mobile in relation to the reference station on the basis of said linear combination of P_a and the complete set of $4p$ pseudo-ranges.

6. (currently amended): The method according to claim 1, wherein the steps b1) and b2) are only carried out for the first linear combination equations in the list, a single step involving the $4p$ pseudo-ranges being carried out for the other linear combination equations in the list.

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7. (currently amended): The method according to claim 1, wherein the 2p pseudo-ranges between the satellites and the reference station are determined by the reference station and sent by radio to the mobile which then comprises reception means to receive these pseudo-ranges and information for dating the measurement of these pseudo-ranges.

8. (currently amended): A device for determining the position of a mobile in relation to a reference station, comprising:

- means for receiving satellite positioning signals; and
- means for receiving a set of 2p pseudo-ranges transmitted by the reference station and representing the pseudo-ranges between the reference station and p satellites for two different carrier frequencies L1 and L2,
- means for periodic determination of a set of 2p pseudo-ranges between the mobile and the p satellites,
- means for supplying the 4p pseudo-ranges to a position-calculating unit,
- means for storing a list of linear combination equations of the frequencies of the positioning signal carriers, and
- means for carrying out, on the basis of the same set of 4p pseudo-ranges, successive calculations of the relative position of the mobile in relation to the position of the reference station, each time based on a different linear combination equation of frequencies chosen from the list, an estimated position Pe and the set of 4p pseudo-ranges, and when the chosen linear combination equation is different from the first linear combination equation in the list, the position estimated in a calculation with a given linear combination equation from the list being the relative position calculated on the basis of the preceding linear combination equation from the list.

9. (currently amended): The method according to claim 2, wherein the first combination equation in the list is the combination equation $L1-L2$ ($a=1$, $b=-1$) and/or the last linear combination equation in the list is the combination equation $9L1-7L2$ ($a=9$, $b=-7$), L1 and L2 being the transmission frequencies of the satellites of the GPS system.

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10. (currently amended): The method according to claim 2, wherein the intermediate combination equations are preferably as follows: $2L1-L2$ ($a=2$, $b=-1$); $3L1-2L2$ ($a=3$, $b=-2$); $4L2-3L1$ ($a=4$, $b=-3$).

11. (currently amended): The method according to claim 3, wherein the intermediate combination equations are preferably as follows: $2L1-L2$ ($a=2$, $b=-1$); $3L1-2L2$ ($a=3$, $b=-2$); $4L2-3L1$ ($a=4$, $b=-3$).

12. (currently amended): The method according to preceding claim 2, wherein step b) comprises the following two steps: b1) calculating an approximate relative position P_a of the mobile in relation to the reference station on the basis of the chosen linear combination equation, P_e and a subset of $4p'$ pseudo-ranges corresponding to p' satellites, where p' is less than p and where the p' satellites chosen from the arrangement of p satellites are those which, taking into account the current geometry of the arrangement, are least sensitive to an error in the estimated position. b2) calculating a precise relative position P_p of the mobile in relation to the reference station on the basis of said linear combination of P_a and the complete set of $4p$ pseudo-ranges.

13. (currently amended): The method according to preceding claim 3, wherein step b) comprises the following two steps: b1) calculating an approximate relative position P_a of the mobile in relation to the reference station on the basis of the chosen linear combination equation, P_e and a subset of $4p'$ pseudo-ranges corresponding to p' satellites, where p' is less than p and where the p' satellites chosen from the arrangement of p satellites are those which, taking into account the current geometry of the arrangement, are least sensitive to an error in the estimated position. b2) calculating a precise relative position P_p of the mobile in relation to the reference station on the basis of said linear combination of P_a and the complete set of $4p$ pseudo-ranges.

14. (currently amended): The method according to preceding claim 4, wherein step b) comprises the following two steps: b1) calculating an approximate relative position P_a of the mobile in relation to the reference station on the basis of the chosen linear combination equation,

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P_e and a subset of $4p'$ pseudo-ranges corresponding to p' satellites, where p' is less than p and where the p' satellites chosen from the arrangement of p satellites are those which, taking into account the current geometry of the arrangement, are least sensitive to an error in the estimated position. b2) calculating a precise relative position P_p of the mobile in relation to the reference station on the basis of said linear combination of P_a and the complete set of $4p$ pseudo-ranges.

15. (currently amended): The method according to claim 2, wherein the steps b1) and b2) are only carried out for the first linear combination equation in the list, a single step involving the $4p$ pseudo-ranges being carried out for the other linear combination equations in the list.

16. (currently amended): The method according to claim 3, wherein the steps b1) and b2) are only carried out for the first linear combination equation in the list, a single step involving the $4p$ pseudo-ranges being carried out for the other linear combination equations in the list.

17. (currently amended): The method according to claim 4, wherein the steps b1) and b2) are only carried out for the first linear combination equation in the list, a single step involving the $4p$ pseudo-ranges being carried out for the other linear combination equations in the list.

18. (currently amended): The method according to claim 5, wherein the steps b1) and b2) are only carried out for the first linear combination equation in the list, a single step involving the $4p$ pseudo-ranges being carried out for the other linear combination equations in the list.

19. (previously presented): The method according to claim 2, wherein the $2p$ pseudo-ranges between the satellites and the reference station are determined by the reference station and sent by radio to the mobile which then comprises reception means to receive these pseudo-ranges and information for dating the measurement of these pseudo-ranges.

20. (previously presented): The method according to claim 3, wherein the $2p$ pseudo-ranges between the satellites and the reference station are determined by the reference station and sent by radio to the mobile which then comprises reception means to receive these pseudo-ranges and information for dating the measurement of these pseudo-ranges.